STATE OF CALIFORNIA
STATE WATER RESOURCES CONTROL BOARD

In the matter of:
July 17, 2020 Water Quality Certification For Federal Permit Or License
for Yuba County Water Agency
Yuba River Development Project (FERC No. 2246)

YUBA COUNTY WATER AGENCY’S PETITION FOR
RECONSIDERATION OF JULY 17, 2020 WATER QUALITY
CERTIFICATION FOR FEDERAL PERMIT OR LICENSE

Appendix G

TECHNICAL MEMORANDUM
ON PROJECTED GROUNDWATER IMPACTS

Jim Blanke, PG, CHg, PE
John Ayres, PG, CHg
Sercan Ceyhan, PhD
Matt Wicks
APPENDIX G

TECHNICAL MEMORANDUM ON PROJECTED GROUNDWATER IMPACTS

This technical memorandum evaluates the potential effects on groundwater conditions, and associated effects on domestic well users, due to reductions in surface water supplies that could result from the implementation of the July 17, 2020 Water Quality Certification For Federal Permit Or License (WQC) issued by the State Water Resources Control Board’s (SWRCB) Executive Director to Yuba County Water Agency (Yuba Water). This memorandum’s analysis is based on the Groundwater Sustainability Plan (GSP) for the North Yuba and South Yuba Groundwater Subbasins (Yuba Subbasins) that Yuba Water adopted and filed with the Department of Water Resources (DWR) in early 2020. Specifically, this technical memorandum uses “minimum threshold” conditions analyzed in the GSP to project what groundwater conditions could occur in the Yuba Subbasins as a result of reductions in surface water supplies that could occur under the WQC’s Condition 1(D) if it were to implement the Sacramento/Delta Inflow Objective for the Bay-Delta Water Quality Control Plan proposed in the SWRCB staff’s July 2018 Framework for the Sacramento/Delta Update to the Bay-Delta Plan (State Water Resourced Control Board, 2018). Based on a review of surface-water modeling of the potential implementation of this Objective, along with other potential requirements, prepared by Stephen Grinnell (see Appendix B) and the assumed reductions in surface-water supplies on which the GSP’s “minimum threshold” analysis was based, the GSP and associated modeling provide information useful for understanding the WQC’s potential indirect effects on groundwater in the Yuba Subbasin.

1.0 SUMMARY OF ANALYSIS AND CONCLUSIONS

Implementation of the WQC’s Condition 1(D) could result in the dewatering of domestic wells at levels similar to those indicated in the GSP’s “minimum threshold”/worst-case scenario, given the relatively similar levels of surface-water supply reductions assumed by that GSP scenario and indicated by the Yuba River Development Project (YRDP) Ops Model’s analysis of Condition 1(D)’s projected implementation. The GSP’s “minimum threshold”/worst-case scenario estimates that 76 domestic wells in the North Yuba Subbasin and 116 domestic wells in the South Yuba Subbasin may be dewatered should groundwater levels reach the minimum thresholds. Given the relatively similar level of surface-water supply reductions that is indicated by the YRDP Ops Model’s depiction of the potential implementation of the WQC’s Condition 1(D), implementation of that Condition 1(D) could result in domestic wells in the Yuba Subbasins being dewatered in similar numbers to those depicted in the GSP’s “minimum threshold”/worst-case scenario. Further, given the concentration of shortages in dry and critical years under the WQC’s Condition 1(D) and the assumed uniform percentage reduction in deliveries in the “minimum
threshold”/worst-case scenario, it is likely that the GSP “minimum threshold”/worst-case scenario may underestimate dewatering of shallow domestic wells during periods of prolonged drought under WQC’s Condition 1(D).

2.0 INTRODUCTION

In 2014, in response to continued overdraft of many of California’s groundwater basins, the State of California enacted the Sustainable Groundwater Management Act (SGMA) to provide local and regional agencies the authority to sustainably manage groundwater. While sustainably managed and with stable groundwater levels, the Yuba Subbasins (DWR Bulletin 118 Basin #5-21-60 and Basin #5-21-61) are subject to SGMA due to prioritization by DWR. SGMA requires preparation of a GSP to reach sustainability within 20 years of implementing their sustainability plans. Within the framework of SGMA, sustainable groundwater management is defined as the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results.

In general, SGMA requires groundwater sustainability agencies (GSAs) to manage groundwater sustainably and avoid undesirable results. Undesirable results may adversely affect municipal, domestic, irrigation, and environmental uses. Yuba Water and the other GSAs and water managers in the Yuba Subbasins are managing groundwater sustainably by using conjunctive use strategies to deliver surface water combined with groundwater pumping to meet water demands.

In the Yuba Subbasins, avoidance of chronic lowering of groundwater levels is the driver for sustainable groundwater management in the Yuba Subbasins, as the other indicators of sustainable management are all correlated with groundwater levels. Given the importance of the groundwater levels indicator and given the added complexity of conjunctively managed groundwater subbasins, additional non-regulatory criteria (local management levels) were developed and adopted by Yuba Water in the GSP to assist in management. Local management levels and minimum thresholds for groundwater levels, together with the other sustainable management criteria, were developed for each of the identified representative monitoring wells.

- Local management levels are non-regulatory criteria Yuba Water and the other GSAs developed and are used by the GSP to identify locally preferred minimum groundwater levels that may not reflect significant and unreasonable effects in the Yuba Subbasins. The local management levels also trigger adaptive management actions. These levels consider domestic well depths and the representative wells’ historical-low groundwater levels. By the way they are defined, local management levels are never deeper than the minimum thresholds.

- Minimum thresholds collectively define when undesirable results occur and individually trigger adaptive management actions. They consider historical low groundwater levels, domestic well depth, and a minimum of 75 feet to groundwater.
3.0 HISTORICAL YUBA COUNTY GROUNDWATER CONDITIONS

The Yuba Subbasins have a long history of proactive and collaborative management of water resources, with strong participation of local water management agencies, stakeholders, and state and federal agencies. Examples of this proactive management are the long-term stable groundwater level conditions in the North Yuba Subbasin and the efforts that led to reversing a potentially serious overdraft situation that existed in the South Yuba Subbasin before deliveries from Yuba Water’s YRDP began in the mid-1980s.

Water managers in the Yuba Subbasins combined this proactive groundwater management with their surface water operations to create a robust conjunctive use program that allows the Yuba Subbasins greater operational flexibility. This conjunctive use program has been effective in maintaining the groundwater subbasins near historical high levels while meeting the challenge of delivering reliable water supply to the local economy during California’s historic drought of 2014-2016, maintaining environmental flow requirements in the lower Yuba River, and contributing to state-wide water needs.

3.1 South Yuba Subbasin Historical Conditions

The South Yuba Subbasin generally is the portion of Yuba County south of the Yuba River as shown in Figure 3. Farmers in the South Yuba Subbasin had historically used exclusively groundwater for irrigation, and between 1948 and 1981, groundwater levels in the South Yuba Subbasin declined an estimated 130 feet. With the region recognizing the unsustainable conditions, in 1984, water from Yuba Water’s New Bullards Bar Reservoir began to be delivered to the South Yuba Subbasin to offset groundwater extraction and allow groundwater levels to recover. With the delivery of surface water, groundwater levels recovered to pre-1948 levels (Figure 1, with location shown in Figure 3).

Figure 1 – South Yuba Subbasin Hydrograph
3.2 North Yuba Subbasin Historical Conditions

The North Yuba Subbasin generally is the portion of Yuba County located north of the Yuba River, as shown in Figure 3. Groundwater levels in the North Yuba Subbasin have been stable over the period of record, with short-term fluctuations representing declines of groundwater levels during summers or droughts and recovery of groundwater levels during winters or wetter periods. Surface water has been used in the North Yuba Subbasin for irrigation for over 100 years, with additional surface water supplies added in the late 1970s. Figure 2 shows a hydrograph from the North Yuba Subbasin (well location shown in Figure 3), reflecting this sustainable conditions with stable groundwater levels and an increase in groundwater levels in the late 1970s.

Figure 2 – North Yuba Subbasin Hydrograph
Figure 3 – North and South Yuba Hydrograph Locations
4.0 COMPARISON OF SIMULATIONS PERFORMED FOR THE GSP WITH THE JULY 2018 FRAMEWORK FOR THE SACRAMENTO/DELTA UPDATE TO THE BAY-DELTA PLAN

While somewhat different, the methodology used in Appendix B submitted with this memorandum to evaluate the potential water-supply effects of implementing the WQC’s Condition 1(D) is sufficiently similar to the methodology used in the GSP to model its “minimum threshold”/worst-case scenario that this GSP analysis is useful for understanding the potential effects of implementing the WQC’s Condition 1(D).

As discussed in more detail below in Section 5, integrated groundwater-surface water simulations of the Yuba Subbasins to support the GSP using the Yuba Groundwater Model (YGM) included a scenario for reduced water supply from the Yuba River. The scenario was developed by iteratively reducing surface water deliveries in the North and South Yuba Subbasins until just before undesirable results were achieved. These reductions were applied as a uniform percentage across all year types. This iterative process resulted in the final simulation with an annual average reduction in diversion of surface water to the Yuba Subbasins: split 34,000 AFY in the North Yuba and 42,000 AFY in the South Yuba Subbasin. Additionally, there is a reduction of 4,000 AFY of water that is not diverted that would have been recharged to groundwater during conveyance. Finally, there is an unquantified reduction in diverted water that returns to the Yuba River as tailwater (operational flows) and groundwater recharge occurring as that tailwater is conveyed back to the river. This is a total reduction of surface water diversions of approximately 80,000 AFY, with a net average increased demand on the Subbasins’ groundwater of 76,000 AFY.

Stephen Grinnell has provided the results of his analysis of the potential implementation of the WQC’s Condition 1(D). His analysis involves using the YRDP Ops Model to model the potential reductions in surface-water supplies from the YRDP as a result of Condition 1(D)’s implementation. The YRDP Ops Model was used to simulate compliance with a 55% of unimpaired flow of the Yuba River watershed at the Marysville Gage. This assumption reflected proposed new Sacramento/Delta Inflow Objective for the Bay-Delta Water Quality Control Plan stated in the State Water Resources Control Board staff’s July 2018 Framework for the Sacramento/Delta Update to the Bay-Delta Plan, as well was other potential increases in Yuba River streamflow requirements. Note that while the GSP “minimum threshold” scenario applied a uniform percent reduction to deliveries across all year types, the YRDP Ops Model simulation of Condition 1(D) includes projected shortages in critical years that are approximately 12 times higher than the shortages in wet years. Using the same time period simulated in the YGM for the GSP the average annual shortage in the Ops Model simulation of Condition 1(D) is 70,000 AFY, or approximately 12.5% less shortage than the 80,000 AFY simulated in the YGM scenario.
Given the similarities in surface water delivery reductions between the YGM simulation used in the GSP to develop estimates of sustainable yield and the Ops Model simulation of Condition 1(D), results from the YGM, as summarized in Section 3, are used in this technical memorandum as an estimate of potential groundwater and domestic well impacts under Condition 1(D). As discussed in more detail below in Section 6.0, the “minimum threshold”/worst-case analysis in the GSP indicates that implementation of the WQC’s Condition 1(D) likely would result in the dewatering of shallow domestic wells in the Yuba Subbasins if it were applied according to the assumptions about the implementation of new Bay-Delta Water Quality Control Plan requirements as assumed in the YRDP Ops Model. Further, given the concentration of shortages in dry and critical years under the WQC’s Condition 1(D), it is likely that the YGM simulation may underestimate dewatering of shallow domestic wells during periods of prolonged drought under WQC’s Condition 1(D).

5.0 SUMMARY OF GROUNDWATER SUSTAINABILITY PLAN ANALYSIS OF PROJECTED “MINIMUM THRESHOLD” CONDITIONS

5.1 Sustainable Groundwater Management Act Requirements and Analysis

The GSP describes how Yuba Water and other water managers in the Yuba Subbasins plan to continue to be manage the subbasins sustainably. In brief, sustainable groundwater management is the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon of the GSP without causing undesirable results. Undesirable results for groundwater levels identify when conditions would have significant and unreasonable adverse effects on beneficial uses of groundwater in the Yuba Subbasins.

5.1.1 Undesirable Result

The GSP identifies the undesirable result for the chronic lowering of groundwater levels as a result that would cause significant and unreasonable reduction in the long-term viability of domestic, agricultural, municipal, or environmental uses over the planning and implementation horizon of the GSP. If groundwater levels were to reach levels indicating undesirable results, potential effects could include the following:

- De-watering of a subset of the existing groundwater infrastructure, starting with the shallowest wells that are generally domestic wells
- Increased costs to pump groundwater
- Adverse effects on groundwater dependent ecosystems, to the extent such ecosystems are connected with the production aquifer
- Changes in irrigation practices and crops grown
- Adverse effects to property values and the regional economy
- Adverse effects to current and projected municipal uses and uses at sites such as Beale Air Force Base, increasing costs for supplying water
5.1.2 Local Management Level

The local management level is a non-regulatory criterion Yuba Water adopted in the GSP to identify locally preferred minimum groundwater levels. These values are based on the lower of historical low groundwater levels and depth of nearby shallowest domestic wells. Groundwater levels below the local management level are not considered significant and unreasonable, and thus not minimum thresholds, but are conditions that local stakeholders and water managers seek to avoid. The local management levels provide triggers and guidance for implementation of adaptive management. The local management levels also support identification of localized issues that may require management, again through adaptive management, to avoid reaching minimum thresholds and reduce impacts on beneficial users of groundwater.

The local management level is protective of groundwater infrastructure, and when groundwater levels are maintained at or above the local management level, domestic wells in the Yuba Subbasins are not likely to be dewatered, based on the best available data.

5.1.3 Minimum Thresholds

Minimum thresholds are the quantitative values that represent groundwater conditions at a representative monitoring site that, when exceeded in combination with minimum thresholds at other monitoring sites, may cause an undesirable result in the basin. Yuba Water and the other GSAs set minimum thresholds in the GSP at representative monitoring sites by considering the interests of beneficial uses and users of groundwater, land uses, and property interests in the subbasins.

The minimum threshold is developed in the same manner as the local management level, except with the addition of a 75-foot minimum value for the depth of the threshold.

5.1.4 Sustainable Yield

Sustainable yield is defined in SGMA as the maximum quantity of water, calculated over a base period representative of long-term conditions in the subbasins and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result (Water Code § 10721(w)). Sustainable yield within the Yuba Subbasins is estimated based on maintaining, on a long-term basis, groundwater levels that do not cause undesirable results.

To estimate the sustainable yield within the North Yuba and South Yuba subbasins, the YGM was used to estimate pumping associated with groundwater level conditions just above what would be considered undesirable results. These conditions would generally be below the local management levels, with dewatering of some domestic wells anticipated to occur. These conditions were not considered to be undesirable results because: (1) the large majority of groundwater pumping in the Yuba Subbasins is for agricultural purposes through deeper wells; (2) the South Yuba Subbasin in particular historically had been drawn down further than these levels without significant undesirable results occurring; and (3) it would be possible to address issues with domestic wells in other ways, if necessary.
Part of GSP development was consideration of conditions that would lead to undesirable results. As the Yuba Subbasins are well managed and resilient under potential climatic and development conditions, there were few likely scenarios that would result in unsustainable conditions. The potential cause of undesirable results that was pursued as part of the sustainable yield analysis was reduction in surface water availability due to potential adoption and implementation by the State Water Resources Control Board of new and higher Yuba River streamflow requirements through amendments to the Bay-Delta Water Quality Control Plan, among other potential avenues.

The YGM was used to simulate conditions associated with increased groundwater production and decreased surface water deliveries, at a magnitude that would lower groundwater levels to a level just above undesirable results, according to the groundwater levels minimum thresholds. This total groundwater production, which approaches but does not result in undesirable results, is the estimate of sustainable yield.

5.1.5 Estimation of Sustainable Yield Conditions (Conditions at Minimum Thresholds)

In developing the GSP, Yuba Water developed and simulated in the YGM varying levels of decreased surface water deliveries and the associated increased groundwater pumping. The total groundwater production that lowers the groundwater levels to a level just above the undesirable results (defined with the groundwater levels minimum thresholds in the GSP, which is lower than the local management level) was used as the estimate of the sustainable yield.

The scenario that generated groundwater levels that were just above levels considered undesirable results was developed by assigning a 30% reduction in the historical surface water deliveries going to the North Yuba Subbasin and a 45% reduction in the historical surface water deliveries going to the South Yuba Subbasin, uniformly across all year types. Analysis of this scenario estimates that that the following would be involved in the scenario:

- A 34 TAFY average annual reduction in surface water deliveries in the North Yuba Subbasin
- A 42 TAFY average annual reduction in surface water deliveries to the South Yuba Subbasin
- A 4 TAFY average annual reduction of water that percolates to groundwater during conveyance of delivered water in canals (groundwater recharge)
- An unquantified reduction in diverted water that returns to the Yuba River as tailwater (operational flows) and groundwater recharge occurring as that tailwater is conveyed back to the river
- A corresponding increase in groundwater pumping of 34 TAFY in North Yuba and 42 TAFY in South Yuba Subbasins, on an average annual basis
- Groundwater levels would be 24 feet (ft) lower on average (maximum of 43 ft) in the North Yuba Subbasin monitoring wells
• Groundwater levels would be 35 ft lower on average (maximum of 67 ft) in the South Yuba Subbasin monitoring wells

5.2 Dewatering of Domestic Wells

A key concern during the development of the GSP was potential dewatering of domestic wells. To evaluate potential domestic wells that may be dewatered if groundwater levels reach minimum thresholds, Well Completion Report (WCR) data was collected from DWR’s website at https://data.cnra.ca.gov/dataset/well-completion-reports (DWR 2020). The WCR data was sorted by section based on the Public Land Survey System, which is the level of accuracy available with the WCR dataset.

Figure 4 shows the number of identified domestic wells at the centroid of each section, and Thiessen polygons around each representative monitoring well in the GSP. Thiessen polygon areas show the area that is nearest to each representative monitoring well.

The identified domestic wells at each section centroid were grouped together, and the depths indicated for each domestic well were compared to groundwater levels at the representative monitoring well inside the Thiessen polygon. Tables 1 and 2 shows the results of this comparison for each representative monitoring well.

The comparison indicates that the minimum threshold at the representative monitoring wells is deeper than nearby domestic wells in 76 domestic wells in the North Yuba Subbasin and 116 domestic wells in the South Yuba Subbasin. This represents 14% of domestic wells in the North Yuba Subbasin and 15% of domestic wells in the South Yuba Subbasin that may be dewatered should groundwater levels reach the minimum thresholds.

For clarity, these results occurred in the GSP’s YGM modeling analysis of a “minimum threshold”/worst-case scenario in which net demands on the Yuba Subbasins’ groundwater would increase by an average of 76,000 AFY as a result of a reduction of surface-water supplies of an annual average of 80,000 AFY.
Figure 4 – Thiessen Polygons and Associated Section Centroids with Domestic Well Counts
Table 1 – Comparison of Minimum Thresholds to Domestic Well Depths – North Yuba Subbasin

<table>
<thead>
<tr>
<th>Representative Monitoring Well</th>
<th>Sub-basin</th>
<th>Minimum Simulated Groundwater Levels in Sustainable Yield Scenario</th>
<th>Domestic Well Depths (ft bgs)</th>
<th>Dewatered Domestic Wells at Sustainable Yield Groundwater Levels</th>
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North Yuba Subbasin Totals: 534 76

ft bgs = feet below ground surface
ft msl = feet relative to mean sea level
Table 2 – Comparison of Minimum Thresholds to Domestic Well Depths – South Yuba Subbasin

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<th>Representative Monitoring Well</th>
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<th>Minimum Simulated Groundwater Levels in Sustainable Yield Scenario</th>
<th>Domestic Well Depths</th>
<th>Dewatered Domestic Wells at Sustainable Yield Groundwater Levels</th>
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South Yuba Subbasin Totals: 795 116

ft bgs = feet below ground surface
ft msl = feet relative to mean sea level
CONCLUSION FROM COMPARISON OF GSP ANALYSIS WITH YRDP OPS MODEL ANALYSIS OF WQC CONDITION 1(D)

Groundwater conditions in the Yuba Subbasins have been stable and continue to be stable, largely through successful sustainable management by local agencies. Through conjunctive water management, groundwater levels have been maintained, local well infrastructure has not been impacted, except in isolated situations where mitigated, and the Yuba Subbasins have been able to support statewide water needs during drought.

As discussed above, the “minimum threshold”/worst-case scenario analyzed in the GSP for the Yuba Subbasins involved an assumed 30% reduction in the historical surface water deliveries going to the North Yuba Subbasin and a 45% reduction in the historical surface water deliveries going to the South Yuba Subbasin. Analysis of this scenario estimates that that the following effects would occur:

- 34 TAFY average annual reduction in surface water deliveries in the North Yuba Subbasin
- 42 TAFY average annual reduction in surface water deliveries to the South Yuba Subbasin
- A 4 TAFY average annual reduction of water that is lost during conveyance of delivered water in canals (groundwater recharge)
- An unquantified reduction in diverted water that returns to the river as tailwater (operational flows) and groundwater recharge occurring as that tailwater is conveyed back to the river
- Corresponding increase in groundwater pumping of 34 TAFY in North Yuba and 42 TAFY in South Yuba Subbasins, on an average annual basis
- Groundwater levels would be 24 ft lower on average (maximum of 43 ft) in the North Yuba Subbasin monitoring wells
- Groundwater levels would be 35 ft lower on average (maximum of 67 ft) in the South Yuba Subbasin monitoring wells

Based on this scenario, the GSP compared lowered groundwater levels and records of domestic well depths discussed in Section 5.2 indicates that the minimum threshold at the representative monitoring wells is lower than nearby domestic wells in 76 domestic wells in the North Yuba Subbasin and 116 domestic wells in the South Yuba Subbasin. The domestic wells that are shallower than the minimum threshold represent 14% of domestic wells in the North Yuba Subbasin and 15% of domestic wells in the South Yuba Subbasin that may be dewatered should groundwater levels reach the minimum thresholds.

As also discussed above, the analysis of the potential effects of the WQC’s Condition 1(D) indicates that it could result in an average-annual reduction in surface-water supplies from the
YRDP of approximately 70,000 AFY, which is 12.5% lower than the average-annual 80,000-AFY reduction on which the GSP’s “minimum threshold”/worst-case scenario is based. The GSP’s analysis indicated that this scenario could result in dewatering 14% of domestic wells in the North Yuba Subbasin and 15% of wells in the South Yuba Subbasin. Given the relatively similar level of surface-water supply reductions that is indicated by the YRDP Ops model’s depiction of the potential implementation of the WQC’s Condition 1(D), implementation of that Condition 1(D) could result in domestic wells in the Yuba Subbasins being dewatered in similar numbers to those depicted in the GSP’s “minimum threshold”/worst-case scenario. Further, given the concentration of shortages in dry and critical years under the WQC’s Condition 1(D) and the assumed uniform percentage reduction in deliveries in the “minimum threshold”/worst-case scenario, it is likely that the GSP “minimum threshold”/worst-case scenario may underestimate dewatering of shallow domestic wells during periods of prolonged drought under WQC’s Condition 1(D).

7.0 REFERENCES

